# ROOFING SHINGLES PROVIDED WITH RELEASE COATING

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention is directed to roofing shingles provided with a release coating. More specifically, the present invention focuses upon laminated roofing shingles whose bottom surface is coated with a continuous film of release material characterized by poor interlaminar strength.

### 2. Background of the Prior Art

Roofing shingles are often divided into two main groups: strip shingles and dimensional or laminated shingles. The most common type of roofing shingles are laminated. These laminated shingles, often referred to as "architectural shingles," include a top layer, which those skilled in the art speak of as the "anterior layer" and a bottom layer, referred to as the "posterior layer." The back surface of the anterior layer is bonded to the front surface of the posterior layer. The posterior layer is bonded so that it mates with the lower butt portion of the anterior layer and further overlaps the anterior layer over a fraction of the undivided headlap portion.

Strip shingles are also prevalent. Strip shingles are single layer asphalt shingles that are manufactured in strips, typically three times as long as they are wide.

A problem associated with both laminated and strip roofing shingles lies in shipment and storage of these shingles. Shingles are packaged in bundles of 20 to 25 shingles. Laminated shingles are bundled in either alternating anterior layer to

anterior layer and posterior layer to posterior layer configuration or each shingle is stacked one atop another so that the anterior layer of a first shingle faces the posterior layer of the adjoining shingle, that is, front surface-to-front surface, back surface-to-back surface or front surface-to-back surface. Furthermore, the bundles are typically stacked and palletized in independent columns or in an interwoven "E" pattern.

Independent of the bundling method, the high pressure caused by stacking of these heavy roofing shingles, causes the shingles to stick together. Additionally, there is a transition region found in many laminated shingles due to the posterior layer having a smaller width than the anterior layer added thickness caused by the overlapping shingle layers in laminated shingles creates a hump. This transition region is most often characterized by a stepped profile. The stepped transition region located at the sharp transition in thickness between the top portion of the anterior layer, which is unbonded, and the portion of that layer bonded to the posterior layer, results in a pressure point within the stack. The pallet arrangements magnify the pressure observed in a single stack. As such, pressure at the pressure point of each shingle is magnified. This pressure point results in distortion and localized sticking of the shingles. The degree of sticking together of adjoining shingles is proportional to load, which imparts pressures. Thus, shingles at the bottom of a stack are more prone to sticking than those at the top where the pressure is lower.

The sticking together of roofing shingles is observed predominantly during warmer months and in hotter climates when temperatures approach the softening point of the shingle asphalt coating, resulting in asphalt flow. The sticking is also a function of time where longer periods of compression time increase the sticking. The combination of high temperature and long storage times results in very damaging sticking. Mechanical interlock of asphalt within the granules under the effect of the pressure point also contributes to the sticking phenomenon.

The problem discussed above has been recognized in the art. Among the expedients attempted to overcome this problem has been the application of a plastic release tape, positioned in the pressure point region of each shingle. This method has been successful, albeit not 100% effective. Not only is this method not totally effective but, in addition, application of release tape adds significant material and labor expense.

The failure to find a complete solution to the problem of sticking together of roofing shingles when stacked in stacks of a plurality of roofing shingles and disposed on pallets during shipping and storage of roofing shingles prior to installation on building roofs evidences the need in the art for a new roofing shingle which overcomes this problem. The solution to this problem is constrained by the need to retain the roofing shingle design that has proven effective in protecting roofs.

## BRIEF SUMMARY OF THE INVENTION

A new roofing shingle has now been developed which overcomes the problem of sticking together of roofing shingles, when stacked in a plurality of roofing shingles and disposed on pallets, during transit and storage. This new shingle design does not adversely affect roofing shingle performance in protecting roofs and represents a minimal additional expense in terms of additional processing complexity and component cost.

In accordance with the present invention a new roofing shingle has been developed. The shingles of this invention include mono- and multi ply types as in a roll on sheet used for built up roofing and also includes individual shingles of the tabbed variety which in turn includes mono-layered and composite types having a headlap portion and a tabbed portion with or without a backer strip underlying the tabs. The shingle includes a surface coated with a release coating.

In accordance with the present invention a new method of manufacturing a roofing shingle is disclosed. The method provides for applying a release coating to the shingle during manufacture.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be better understood by reference to the accompanying drawings of which:

Figure 1 is a view of the top surface of a laminated roofing shingle in accordance with the present invention;

Figure 2 is a view of the bottom surface of the roofing shingle of Figure 1 in accordance with the present invention.

## DETAILED DESCRIPTION

The following detailed description of the invention is to a 2-ply laminated shingle for convenience but the invention is not limited to such a shingle. The roofing shingle 1 in accordance with the present invention is depicted as it appears viewed from its top surface in Figure 1 and from its bottom surface in Figure 2. The roofing shingle is preferably a laminate of an anterior layer 2 having a front surface and a back surface and posterior layer 5 having a front surface and a back surface. The anterior layer includes an undivided headlap portion 3 and a lower butt portion 4. The posterior layer 5, often referred to in the art as a "backer strip," is usually rectangularly shaped. The front surface of the posterior layer 5 is bonded to the back surface of the anterior layer 2 so that it completely mates with the lower butt portion 4 and provides an overlap of the two layers over a fraction of the undivided headlap portion 3. However, the shingle may be mono-layered or have three or more layers.

Both the anterior layer 2 and the posterior layer 5 preferably comprise a fiberglass mat, an organic or inorganic felt or fabric stock impregnated with asphalt and coated with weather resistant mineral granules.

To provide a roofing shingle 1 which does not stick to its neighboring shingles in a stack, especially when the stack is disposed on a pallet, a coating of a release material 100 is placed on the bottom surface of the shingle 1, as depicted in Figure 2, and the shingles 1 are bundled so that the top surface of each shingle is adjacent the bottom surface of its neighboring shingle. The release coating comprises a continuous film of solid particles having poor interlaminar strength when applied as a slurry coating.

Particles that result in a film with poor interlaminar strength have good to excellent basal cleavage. The coating of the present invention comprises particles from the class preferably comprised of phyllosilicates, which have rings of tetrahedrons linked by shared oxygens to other rings in a two dimensional plane that produce a sheet-like structure. Layers of weakly bonded cations, often having water molecules and other neutral atoms or molecules trapped between them, typically connect the sheet structures.

The particles used by the present invention are characterized as being substantially flat, platy, and displaying good to perfect basal cleavage. Cleavage is the splitting or tendency of a crystal to split along definite crystalline planes to produce substantially planar surfaces. The quality of the cleavage plane is expressed with the terms perfect, good (well defined, but not completely even) and poor (difficult to recognize). Cleavage resulting in one non-parallel cleavage plane is called basal cleavage. Basal cleavage is a type of cleavage across a horizontal plane of a mineral by its base or top and bottom closing points. Minerals with good to perfect basal cleavage can be peeled which is the desired function on the particles for the present invention.

Particles meeting this criterion include the minerals of the mica family, which are all characterized by sheets of silicate. Other preferred particles include graphite, magnesium silicate, magnesium sulfite, clays, and crystals intergrown with mica and clay layers forming a composite crystal.

Specific examples include but are not limited to:

Allophane *(Hydrated Aluminum Silicate)*;

Apophyllite *(Hydrated Potassium Sodium Calcium Silicate Hydroxide Fluoride)*;

Bannisterite *(Hydrated Potassium Calcium Manganese Iron Zinc Aluminum Silicate Hydroxide)*;

Carletonite *(Hydrated Potassium Sodium Calcium Silicate Carbonate Hydroxide Fluoride)*;

Cavansite *(Hydrated Calcium Vanadate Silicate)*;

Chrysocolla *(Hydrated Copper Aluminum Hydrogen Silicate Hydroxide)*;

Baileychlore *(Zinc Iron Aluminum Magnesium Silicate Hydroxide)*;

Chamosite *(Iron Magnesium Aluminum Silicate Hydroxide Oxide)*;

Chlorite;

Clinochlore *(Iron Magnesium Aluminum Silicate Hydroxide)*;

Cookeite *(Lithium Aluminum Silicate Hydroxide)*;

Nimite *(Nickel Magnesium Iron Aluminum Silicate Hydroxide)*;

Pennantite *(Manganese Aluminum Silicate Hydroxide)*;

Penninite *(Iron Magnesium Aluminum Silicate Hydroxide)*;

Sudoite *(Magnesium Aluminum Iron Silicate Hydroxide)*;

Glauconite *(Potassium Sodium Iron Aluminum Magnesium Silicate Hydroxide)*;

Illite *(Hydrated Potassium Aluminum Magnesium Iron Silicate Hydroxide)*;

Kaolinite *(Aluminum Silicate Hydroxide)*;

Montmorillonite *(Hydrated Sodium Calcium Aluminum Magnesium Silicate Hydroxide)*;

Palygorskite *(Hydrated Magnesium Aluminum Silicate Hydroxide)*;

Pyrophyllite *(Aluminum Silicate Hydroxide)*;

Sauconite *(Hydrated Sodium Zinc Aluminum Silicate Hydroxide)*;

Talc *(Magnesium Silicate Hydroxide)*;

Vermiculite *(Hydrated Magnesium Iron Aluminum Silicate Hydroxide)*;

Delhayelite *(Hydrated Sodium Potassium Calcium Aluminum Silicate Chloride Fluoride Sulfate)*;

Elpidite (H*ydrated Sodium Zirconium Silicate);*

Fedorite (*Hydrated Potassium Sodium Calcium Silicate Hydroxide Fluoride);*

Franklinfurnaceite *(Calcium Iron Aluminum Manganese Zinc Silicate Hydroxide);*

Franklinphilite *(Hydrated Potassium Manganese Aluminum Silicate;)*

Gonyerite *(Manganese Magnesium Iron Silicate Hydroxide);*

Gyolite (*Hydrated Calcium Silicate Hydroxide)*;

Leucosphenite (*Hydrated Barium Sodium Titanium Boro-silicate);*

The Mica Group:

Biotite *(Potassium Iron Magnesium Aluminum Silicate Hydroxide Fluoride);*

Lepidolite *(Potassium Lithium Aluminum Silicate Hydroxide Fluoride)*;

Muscovite *(Potassium Aluminum Silicate Hydroxide Fluoride);*

Paragonite *(Sodium Aluminum Silicate Hydroxide);*

Phlogopite *(Potassium Magnesium Aluminum Silicate Hydroxide; Fluoride)* and

Zinnwaldite (*Potassium Lithium Aluminum Silicate Hydroxide Fluoride).*

Minehillite (*Hydrated Potassium Sodium Calcium Zinc Aluminum Silicate Hydroxide);*

Nordite (*Cerium Lanthanum Strontium Calcium Sodium Manganese Zinc Magnesium Silicate);*

Pentagonite *(Hydrated Calcium Vanadate Silicate);*

Petalite (*Lithium Aluminum Silicate);*

Prehnite *(Calcium Aluminum Silicate Hydroxide);*

Rhodesite *(Hydrated Calcium Sodium Potassium Silicate);* and

Sanfornite *(Barium Silicate);*

Antigorite *(Magnesium Iron Silicate Hydroxide);*

Clinochrysotile *(Magnesium Silicate Hydroxide);*

Lizardite *(Magnesium Silicate Hydroxide);*

Orthochrysotile *(Magnesium Silicate Hydroxide);*

Serpentine *(Iron Magnesium Silicate Hydroxide);*

Wickenburgite *(Hydrated Lead Calcium Aluminum Silicate)*; and

Zeophyllite (*Hydrated Calcium Silicate Hydroxide Fluoride).*

The particles mentioned above all meet a further requirement. That is, the particles must be capable of forming a continuous film when applied as a dispersion. The dispersion, for economic and environmental reasons, is preferably an aqueous dispersion. A dispersant may or may not be utilized to aid dispersing of the particles.

The present invention encompasses the utilization of the aforementioned coating on all or a portion of a surface of the shingles. The invention is therefore embodied in terms of single ply, multi-ply laminated shingles and roll roofing. Optimum results, in terms of application and material costs, is obtained when the coating is applied to the "pressure point" portion of the laminate shingle 1. The pressure point, generally defined above, is at, and immediately above and below the top edge of the posterior layer where that top edge overlaps the bottom portion of headlap portion of the anterior layer. This pressure point is generally denoted by reference numeral 6 in Figure 2. For roll roofing it is preferred to coat the entire back side. The coating should be applied to the surface of a shingle that is in contact with the shingle above or below it when stacked. That is, shingles may be stacked front surface-to-front surface, back surface-to-back surface or front surface-to-back surface, in each case the coating is applied to the surfaces in contact with the next shingle when stacked. Preferably, the coating is applied to the exposed asphalt surface in contact with either a granular surface or another exposed asphalt surface.

Although the invention is independent of any theory explaining its effectiveness, it is theorized that sticking between adjacent shingles in a stack occurs principally at the hump in the region where the top of the posterior layer is bonded to the bottom of the headlap region of the anterior layer. This is where thickness of the shingle changes from two layers to one layer, producing a sharp. Pressure is greatest in the stack at this location. As such, it is at this point where adhesion between shingles is most apt to occur. Thus, this region is where application of a release coating, to prevent adhesion, is most preferred.

It is further theorized that the effectiveness of the release coating is predicated upon the continuous film of particles having poor interlaminar strength. These particles peel away from each other or are easily fractured, significantly reducing the force required to separate adjacent shingles from each other. Thus this coating can also be applied to roll roofing to prevent sticking in the roll configuration.

The self-seal adhesive embodiment of the present invention involves applying the release coating comprising a continuous film of solid particles having poor interlaminar strength to a roofing shingle with a self-seal adhesive. Often, roofing shingles include an adhesive applied to its bottom surface that provides sealing of the shingle to an underlayment, sheathing or other shingle. The coating of the present invention can be applied to the surface of a shingle in contact with the self-seal adhesive prior to packaging to prevent sticking of these shingles in bundles and stacked on pallets. That is, the coating is applied to the front surface or back surface of a shingle that is in contact with the self-seal adhesive of another shingle when bundled or stacked.

The roofing shingle stack aspect of the present invention involves stacking of the aforementioned roofing shingles one atop another such that the top surface of each shingle faces the bottom surface of its adjacent shingle. As stated above, a plurality of shingles are piled atop one another to from a bundle. In a preferred embodiment,

20 to 25 roofing shingles constitute a bundle. Seven to ten of these bundles can then be stacked on top of each other on a pallet.

A roofing shingle is typically manufactured using an apparatus to impregnate a glass mat with a waterproofing compound such as asphalt. Subsequently, one surface can be covered with an adhesive material to which mineral granules are adhered to create a weather surface. In a laminated shingle, the mineral granule coated shingle material is cut into a plurality of anterior layers and posterior layers. Typically the anterior layers comprise a headlap portion and a butt portion. The butt portion thereof can comprise tabs with spaces between these tabs. The spaces and tabs are dimensioned so as to permit pairs of overlay portions to be cut with the tabs thereof in an interleaved configuration. The layers are subsequently laminated together. This and other similar methods known by those in the art are used to manufacture roofing shingles.

A laminating adhesive applicating station is used to laminate the layers during manufacturing. The anterior layer and posterior layer are brought together after a laminating adhesive is applied, thus adhering them. A heat activatable self-seal adhesive may be applied during manufacture to the surfaces of the shingles to seal down the shingle when part of the completed roof shingle structure. Subsequently, shingles are collected stacked front surface-to-front surface, back surface-to-back surface or front surface-to-back surface to form a bundle and palletized for shipment.

The release coating of the present invention may be applied to the portion of a shingle that contacts the heat activatable adhesive material used to seal shingles down during a roof installation. This substantially prevents the sticking of this self seal material during its stacking, storing and shipping.

Also during manufacture, the release coating of the present invention can be applied to the exposed bottom surfaces of the shingles or more preferably at the described pressure points to prevent sticking. The coating is preferably applied by

spraying the coating onto the desired location of the shingle and providing for a drying period. Other methods include brushing or wiping the coating on, dipping the shingle in the suspension, or other methods known in the art.

The following examples are provided to illustrate the scope of the present invention. Because of these examples are given for illustrative purposes only, the present invention should not be deemed limited thereto.

## COMPARATIVE EXAMPLE 1

An example was designed to emulate the sticking together of roofing shingles that occurs when roofing shingles are stacked together in warm temperatures. In this example, a first stack of unmodified roofing shingles measuring 7 inches by 5 inches with the top edge of posterior layer lined up in the middle of the sample going along the 7 inch side was prepared. A second stack of identically sized roofing shingles but wherein the top edge of the posterior layer lined up in the middle of the sample going along the 5 inch side was also prepared. The shingles in each stack were disposed such that the top surface of each shingle was in contact with the bottom surface of the adjoining shingle. The two stacks were thereupon crosslaced by placing the two stacks together.

The crosslaced stack was placed in an oven maintained at 165°F with a 50 lb. weight on its top. The samples were removed from the oven after 16 hours. After the sample cooled to ambient temperature, a wood workers clamp clamped a corner of the top samples. A spring loaded, hand held weighing scale with a hook at its end, hooked the clamp and the force required to pull a shingle from the remainder of the stack was measured in pounds.

A series of 11 such separations was conducted. An average of 7.55 lbs., with a standard deviation of 1.7 lbs., was required to separate these non-treated roofing shingles.

## COMPARATIVE EXAMPLE 2

Comparative Example 1 was identically repeated but for the substitution of roofing shingles in which the pressure point portion of the bottom surface of the shingle was covered with tape as typically done in the industry. The tape used was polyester.

A similar series of 11 separations was conducted. An average of 4.98 lbs. with a standard deviation of 2.01 lbs., was required to separate a single roofing shingle from the stack.

## EXAMPLE 1

Comparative Example 1 was identically reproduced but for the application on the pressure point portion of the bottom side of the shingles of a coating of Nytal®100 talc. The dilution ratio of the release coating was five parts water to one part Nytal.

The average force required to separate the 11 roofing shingles was 7.69 lbs. with a standard deviation of 3.74 lbs.

## EXAMPLES 2 – 6

Example 1 was reproduced except that the coating of that example was replaced with Graphite 100® synthetic graphite in Example 2; Microlite® vemiculite in Example 3; Desulco® graphite in Example 4; Vantal® 6H magnesium silicate in Example 5; and Nytal®400 talc in Example 6.

Each example involved 11 roofing shingle separations.